CONTENTS

INTRODUCTION			1
1.	WHAT IS ROUGHNESS?		3
	1.A	Scratches and Digs	3
	1.B	Polishing Marks and Microirregularities	5
	1.C	Machining Marks and Grating Grooves	5
	1.D	Dust Particles and Particulates	6
2.	HOV	V DO WE SEE ROUGHNESS?	7
	2.A	Observing Light Scattered by the Surface	7
	2.B	Using a Differential Interference Contrast (Nomarski) Microscope	7
	2.C	Using Electron Microscopes	10
	2.C. 2.C.	1 Transmission Electron Microscope (TEM), 10 2 Scanning Electron Microscope (SEM), 10 3 Scanning Transmission Electron Microscope (STEM), 11 4 Scanning Tunneling Microscope (STM), 11	
3.	HOV	V DO WE MEASURE ROUGHNESS?	13
	3.A	Surface-Profile Measurements	14
		1 Noncontact Methods, 14 2 Contact Methods, 18	
	3.B	Area Topography Measurements	22
	3.C	Determining Roughness from Scattering Measurements	24
	3.C.	 Total Integrated Scattering (TIS), 24 Angle-Resolved Scattering (ARS), 27 Bidirectional Reflectance Distribution Function (BRDF), 30 	
	3.D	Comparison of Methods for Determining Roughness	31

4.	SCATTERING THEORIES AND SURFACE STATISTICS		38	
	4.A Root-Mean-Square and Average Ro and Root-Mean-Square Slope	C .	8	
	 4.A.1 Root-Mean-Square Roughness, 38 4.A.2 Average Roughness and Ten-Point Householder 4.A.3 Root-Mean-Square Slope, 39 4.A.4 Statistical Sampling of Surface Roughness 	ness, 41		
	4.B Height and Slope Distribution Func Skewness, and Kurtosis		2	
	4.B.1 Height Distribution Function, 424.B.2 Skewness and Kurtosis, 434.B.3 Slope Distribution Function, 44			
	4.C Autocovariance Function, Correlation and Surface Spatial Wavelength	0 /	4	
	4.D Power-Spectral-Density Function	4	8	
	4.E Total Integrated Scattering	5	0	
	4.F Angle-Resolved Scattering	5	3	
	4.G Mie Scattering from Particulates	5	5	
5.	STATISTICS FOR SELECTED SURFAC	ES 5	7	
6.	SCATTERING IN THE ULTRAVIOLET	AND X-RAY REGIONS 6	9	
7.	SCATTERING IN THE INFRARED	7	3	
8.	CLEANING AND INSPECTION OF SURFACES		5	
PLA	ATES	8	1	
API	PPENDIX A. ENGLISH AND METRIC UNIT	rs 8	9	
API	PPENDIX B. MEASUREMENT FACILITIES	9	0	
RE	EFERENCES	9	8	
INI	DEX	10	17	